Strand I: Patterns, Relationships, and Functions
Standard 1: Patterns – Students recognize similarities and generalize patterns, use patterns to create models and make predictions, describe the nature of patterns and relationships, and construct representations of mathematical relationships.
Key Ideas:
1. Recognizing, describing and generalizing patterns is the starting point of mathematics.
2. Patterns and relationships are represented and communicated in diverse ways.
3. Patterns enable students to describe and understand the physical world and to make informed predictions.
4. Recognizing and classifying families of patterns enables students to understand and use their mathematical properties.
5. Pattern recognition and analysis provide an important key to solving problems and learning new mathematics.

Middle School Benchmark	Grade 5	Grade 6	Grade 7	Grade 8
1. Describe, analyze and generalize patterns arising in a variety of contexts and express them in general terms.				
2. Represent and record patterns in a variety of ways including tables, charts and graphs, and translate between various representations.		**Represent linear functions using tables, equations, and graphs** **A.RP.06.08** Understand that graphs and tables can suggest relationships between quantities.	**Understand and apply directly proportional functions using basic examples** **A.RP.07.02** Represent directly proportional and linear relationships using verbal descriptions, tables, graphs and formulas, and translate among these representations.	**Understand the concept of non-linear functions using basic examples** **A.RP.08.01** Identify and represent linear functions, quadratic functions, and other simple functions including inverse functions ($y = k/x$), cubics ($y = ax^3$), roots ($y = \sqrt{x}$), and exponentials ($y = a^x$, $a > 0$), using tables, graphs, and equations.
3. Use patterns and their generalizations to make and justify inferences and predictions.				
4. Explore and describe visual and numeric patterns, including linear expressions, near-linear patterns and symmetric and spatial patterns.			**Understand and apply directly proportional relationships; relate to linear relationships** **A.PA.07.01** Recognize when information given in a table, graph or formula suggests a proportional or linear relationship. **A.RP.07.02** Represent directly proportional and linear relationships using verbal descriptions, tables, graphs and formulas, and translate among these representations.	**Understand the concept of non-linear functions using basic examples** **A.RP.08.01** Identify and represent linear functions, quadratic functions, and other simple functions including inverse functions ($y = k/x$), cubics ($y = ax^3$), roots ($y = \sqrt{x}$), and exponentials ($y = a^x$, $a > 0$), using tables, graphs, and equations. **A.PA.08.02** For basic functions, e.g. simple quadratics, direct and indirect variation, and population growth, describe how changes in one variable affect the others.
5. Use patterns and generalizations to solve problems and explore new content.				

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Standard 2: Variability and Change - Students describe the relationships among variables, predict what will happen to one variable as another variable is changed, analyze natural variation and sources of variability, and compare patterns of change.

Key Ideas:
1. Studying change and variability in physical and abstract contexts is an important objective of mathematics.
2. Variability becomes understandable when students recognize patterns of change and natural variation
3. Changes are frequently interdependent; understanding patterns of change in one variable can help students predict changes in another.
4. Variability is represented in a variety of symbolic forms.
5. Functions and relationships are used to model patterns of variability arising from physical and mathematical contexts.
6. Understanding variability and change is a basis for making sense of the world and of mathematical ideas.

Middle School Benchmark	Grade 5	Grade 6	Grade 7	Grade 8
1. Identify and describe the nature of change; recognize change in more abstract and complex situations and explore different kinds of change and patterns of variation.	**Construct and interpret line graphs** **D.RE.05.01** Read and interpret line graphs, and solve problems based on line graphs, e.g., distance - time graphs, and problems with two or three line graphs on same axes, comparing different data.		**Understand and apply directly proportional relationships; relate to linear relationships** **A.PA.07.03** Given a directly proportional or linear situation, graph and interpret the slope and intercept(s) in terms of the original situation; evaluate $y = kx$ for specific x values, given k, e.g., weight vs. volume of water, base cost plus cost per unit. **Understand and solve problems involving rates, ratios, and proportions** **N.FL.07.03** Calculate rates of change, including speed. **N.FL.07.05** Solve simple proportion problems using such methods as unit rate, scaling, finding equivalent fractions, and solving the proportion equation $a/b = c/d$; know how to see patterns about proportional situations in tables.	
2. Connect an initial state to a final state and generalize a rule that describes a pattern of change.				
3. Begin to investigate applications in bivariate data and linear relationships and explore questions of what will happen to one quantity if another variable is changed.			**Understand and solve problems involving rates, ratios, and proportions** **N.FL.07.03** Calculate rates of change, including speed. **N.FL.07.05** Solve simple proportion problems using such methods as unit rate, scaling, finding equivalent fractions, and solving the proportion equation $a/b = c/d$; know how to see patterns about proportional situations in tables.	**Understand the concept of non-linear functions using basic examples** **A.PA.08.02** For basic functions, e.g. simple quadratics, direct and indirect variation, and population growth, describe how changes in one variable affect the others.
4. Represent variability or change by ordered pairs, tables, graphs and equations.		**Represent linear functions using tables, equations, and graphs** **A.RP.06.10** Represent simple relationships between quantities, using verbal descriptions, formulas or equations, tables, and graphs, e.g. perimeter-side relationship for a square, distance-time graphs, and conversions such as feet to inches	**Understand and apply directly proportional relationships; relate to linear relationships** **A.RP.07.02** Represent directly proportional and linear relationships using verbal descriptions, tables, graphs and formulas, and translate among these representations.	
5. Differentiate between functions and relationships such as linear vs. not linear or continuous vs. non-continuous.			**Understand and solve problems about inversely proportional relationships** **A.PA.07.09** Recognize inversely proportional relationships in contextual situations; know that quantities are inversely proportional if their product is constant, e.g., the length and width of a rectangle with fixed area, and that an inversely proportional	**Understand the concept of non-linear functions using basic examples** **A.RP.08.01** Identify and represent linear functions, quadratic functions, and other simple functions including inverse functions ($y = k/x$), cubics ($y = ax^3$), roots ($y = \sqrt{x}$), and exponentials ($y = a^x$, $a > 0$),

			relationship is of the form $y = k/x$ where k is some non-zero number. **A.RP.07.10** Know that the graph of $y = k/x$ is not a line; know its shape, and know that it crosses neither the x nor the y-axis.	using tables, graphs, and equations. **A.PA.08.03** Recognize basic functions in problem context, e.g. area of a circle is r^2, volume of a sphere is $\frac{4}{3} r^3$, and represent them using tables, graphs, and formulas.
6. Continue to explore relationships arising from interesting contexts and use variables and relationships to solve mathematical problems.		**Represent linear functions using tables, equations, and graphs** **A.PA.06.09** Graph and write equations for linear functions of the form $y = mx$ and solve related problems, e.g., given n chairs, the "leg function" is f (n) = 4n: if you have 5 chairs, how many legs? ; if you have 12 legs, how many chairs?		